

## Savanna

**Latitude and Elevation:** Tropical, located between rainforests or woodlands and grasslands or desert.

**Climate:** Very warm, with distinct wet and dry seasons; extreme changes in precipitation.



**Latitude and Elevation:** Found in scattered patches in hilly coastal areas in the middle latitudes.

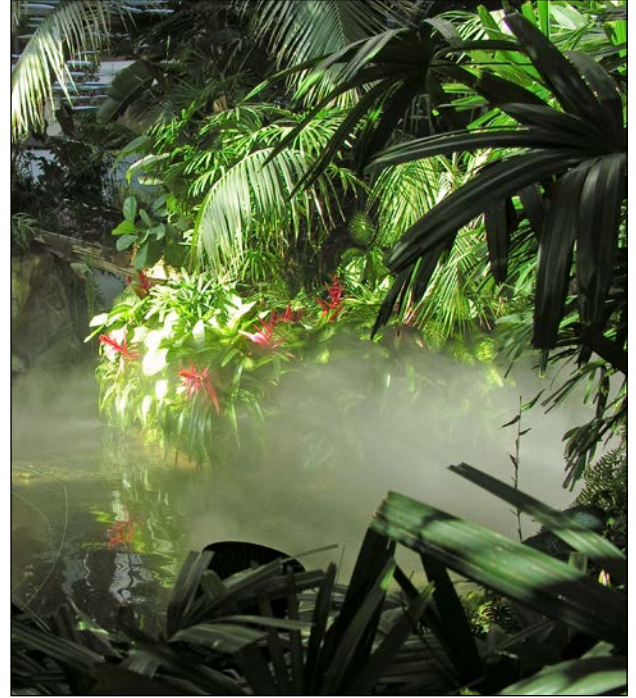
**Climate:** Mild, wet winters and hot, dry summers.

## Chaparral

## Rainforest

**Latitude and Elevation:** Tropical rainforests are found in a band along the Equator, while temperate rainforests are found along coastlines.

**Climate:** Tropical rainforests are consistently warm and very humid. Temperate rainforests are cooler and less humid. Both experience high rainfall, and even higher rainfall during a particular part of the year.



**Latitude and Elevation:** Wide range, in tropical, subtropical, and temperate latitudes.

**Climate:** Very dry—average annual rainfall of 10 inches (25.4 centimeters) or less. Some deserts are hot and dry while others are cold and dry.

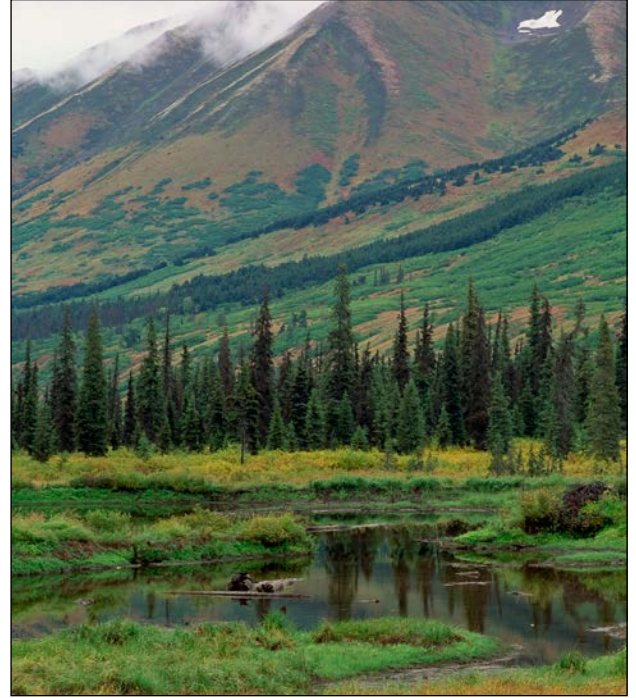
## Desert



## Taiga (Coniferous Forest)

**Latitude and Elevation:** Covers most of inland Alaska, Canada (parts are called boreal forest), Northern Europe, and Russia (especially Siberia). The taiga is the world's largest land-based biome.

**Climate:** Very large temperature change between summer and winter. Summers are short, warm, and humid, while winters are long and very cold. Low levels of precipitation are experienced mostly in summer.



## Deciduous Forest

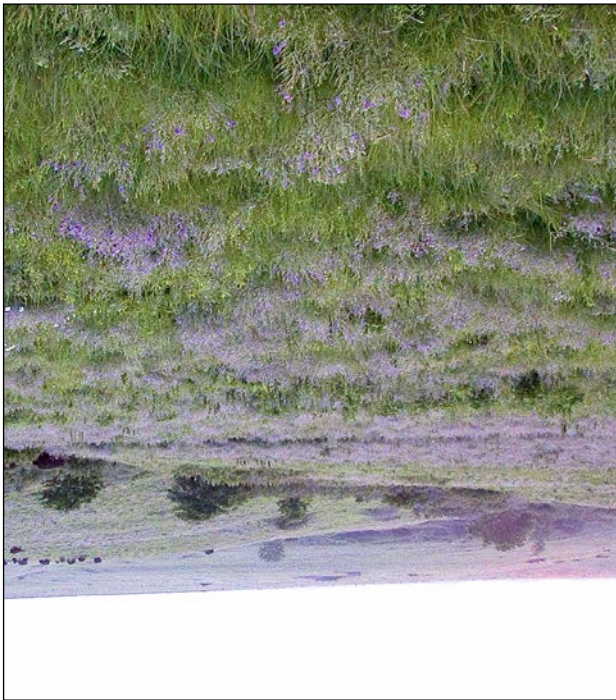
**Latitude and Elevation:** Middle latitudes.

**Climate:** Seasonal temperature changes and moderate precipitation that is spread evenly through the year.

## Alpine

**Latitude and Elevation:** At very high altitude (tall mountains and mountain ranges) at any latitude.

**Climate:** Very similar to tundra. Extremely cold and windy, with soils permanently frozen for much of the year at the highest elevations. Little precipitation.



## Grassland

**Latitude and Elevation:** In the interior of continents, at middle latitudes.

**Climate:** Seasonal, with great differences in temperature between winter and summer. Moderate precipitation, heaviest in the spring.

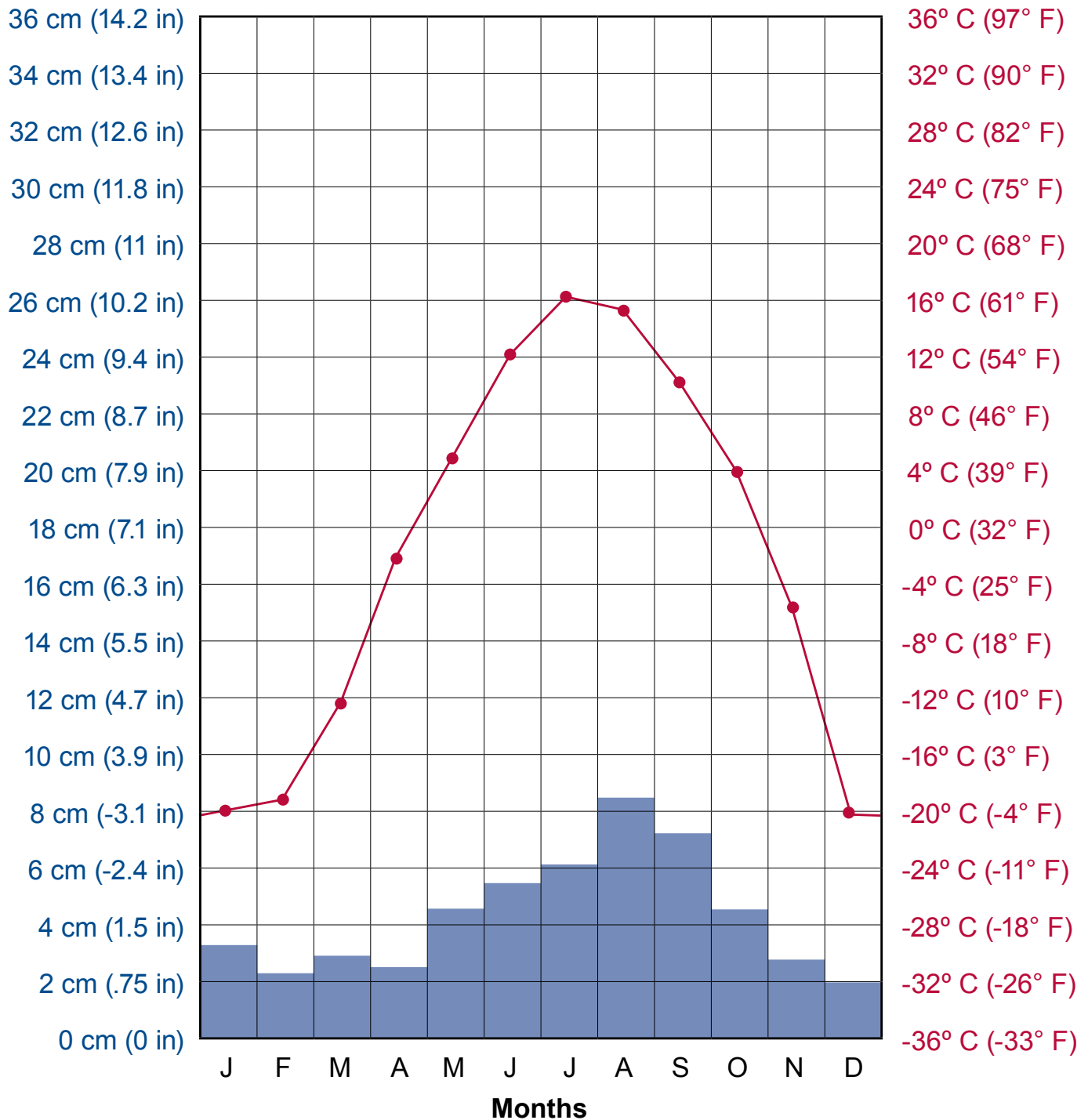
## Tundra

**Latitude and Elevation:** Arctic region, north of the taiga biome, and the Antarctic region.

**Climate:** Extremely cold, frozen for much of the year, and dry. Two seasons: winter and summer. In summer, the upper layer of the frozen ground thaws and marshes, lakes, and streams cover the land. There are, in effect, two layers of soil.

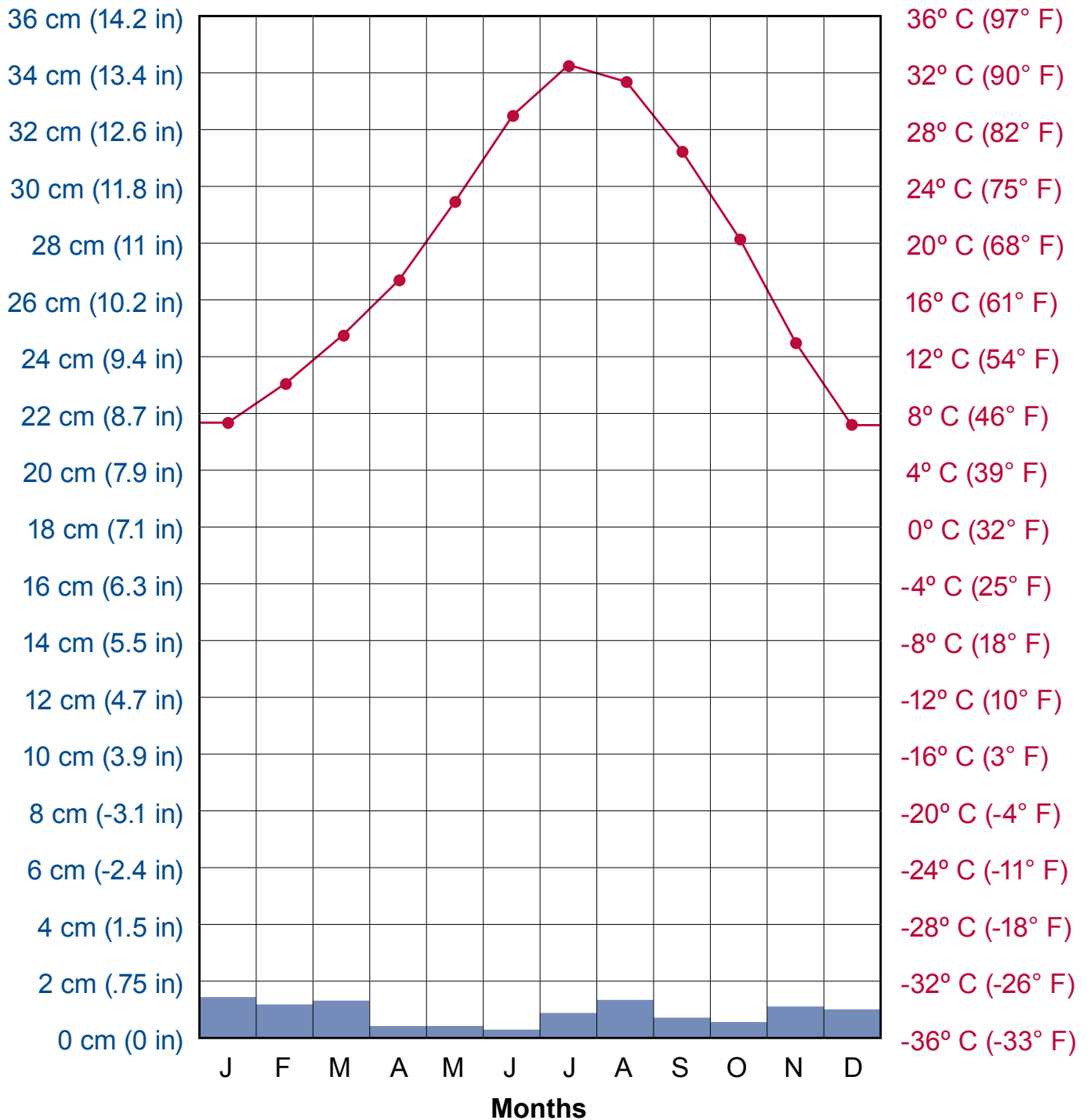




**Taiga (Location: Ontario, Canada)****Rain\*****Temperature\***

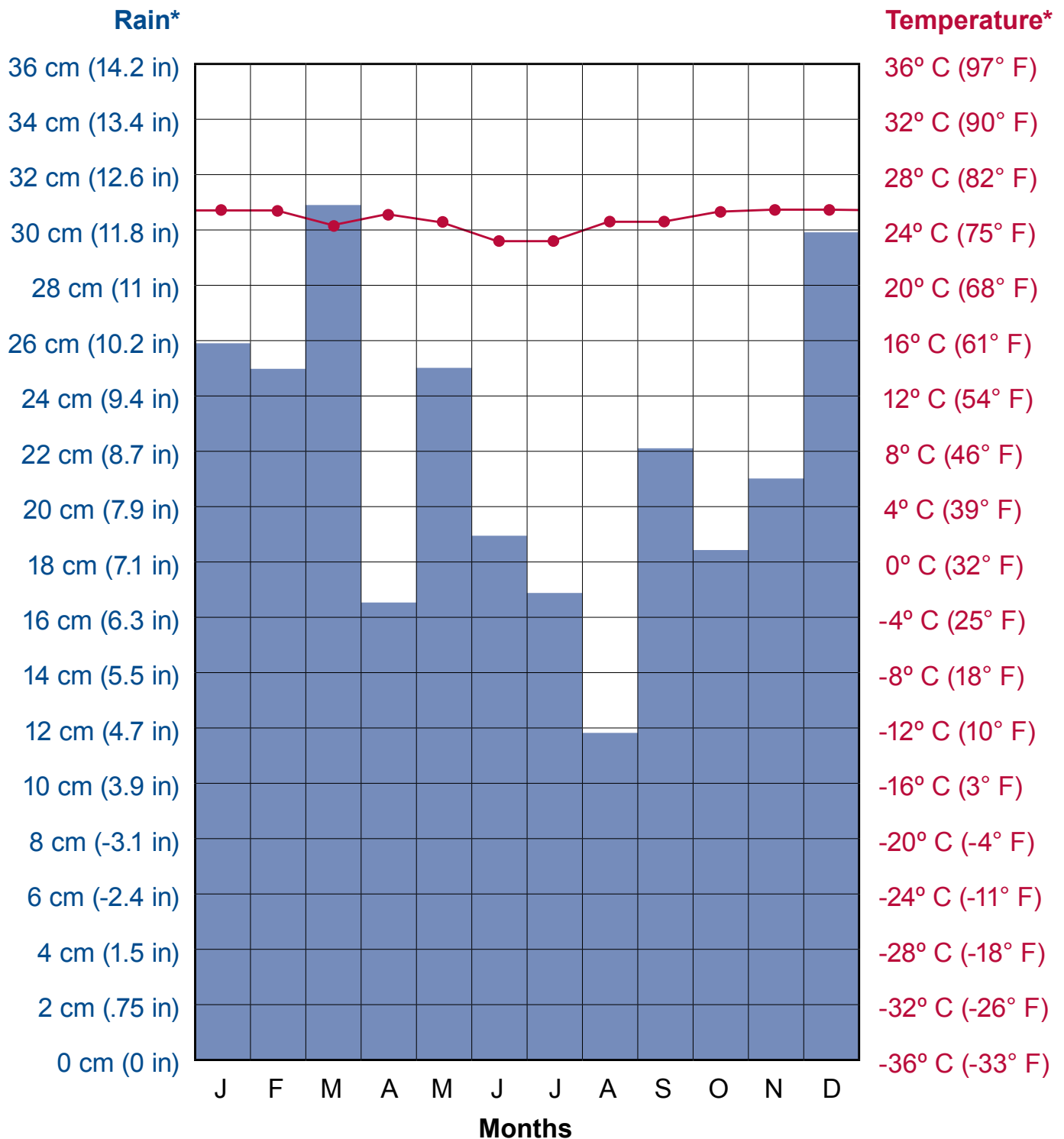
\*Note: Conversions are approximate.

Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)

**Desert (Location: Las Vegas, Nevada)****Rain\*****Temperature\***

\*Note: Conversions are approximate.

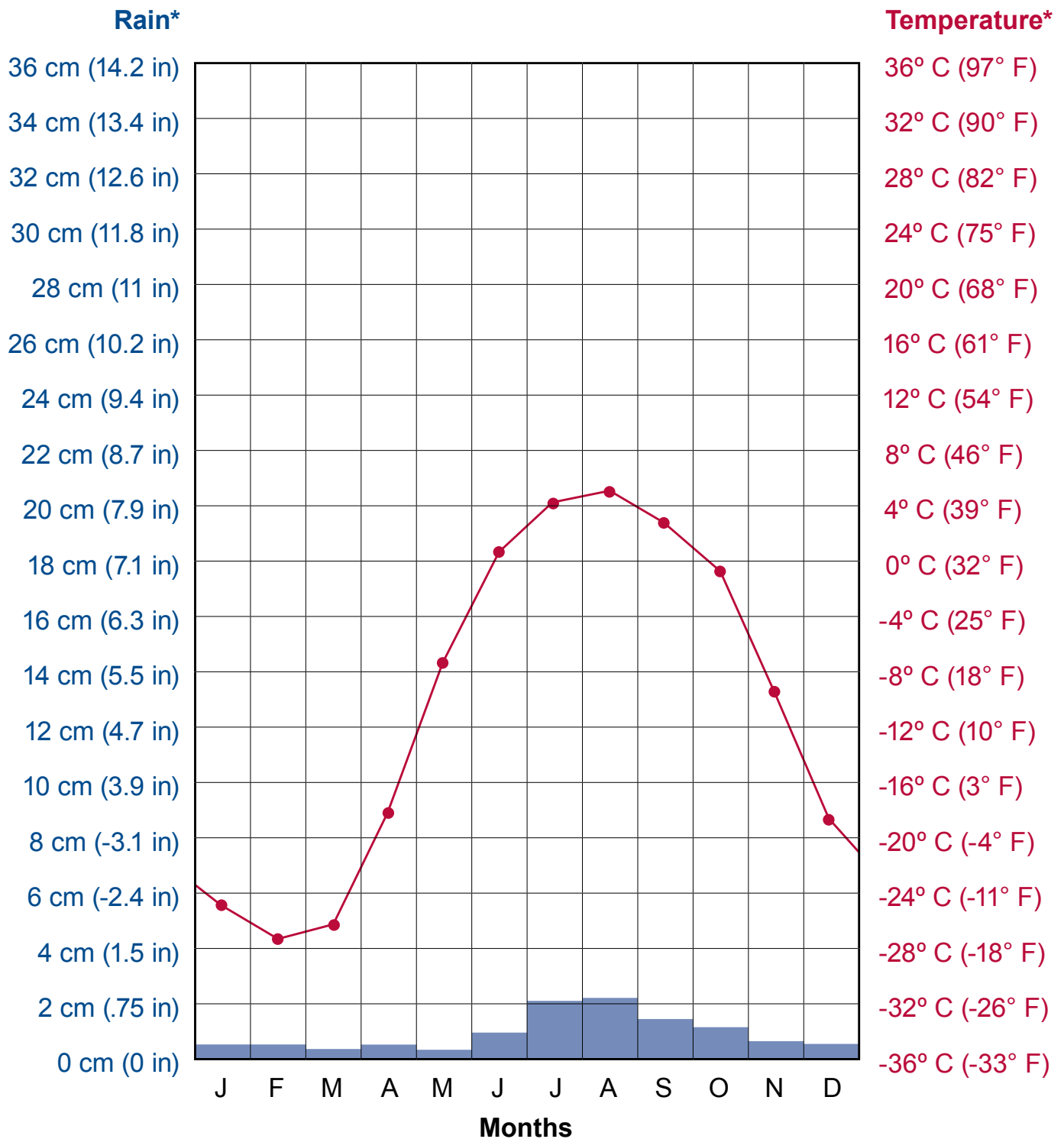
Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)

**Rainforest (Location: Iquitos, Peru)**

\*Note: Conversions are approximate.

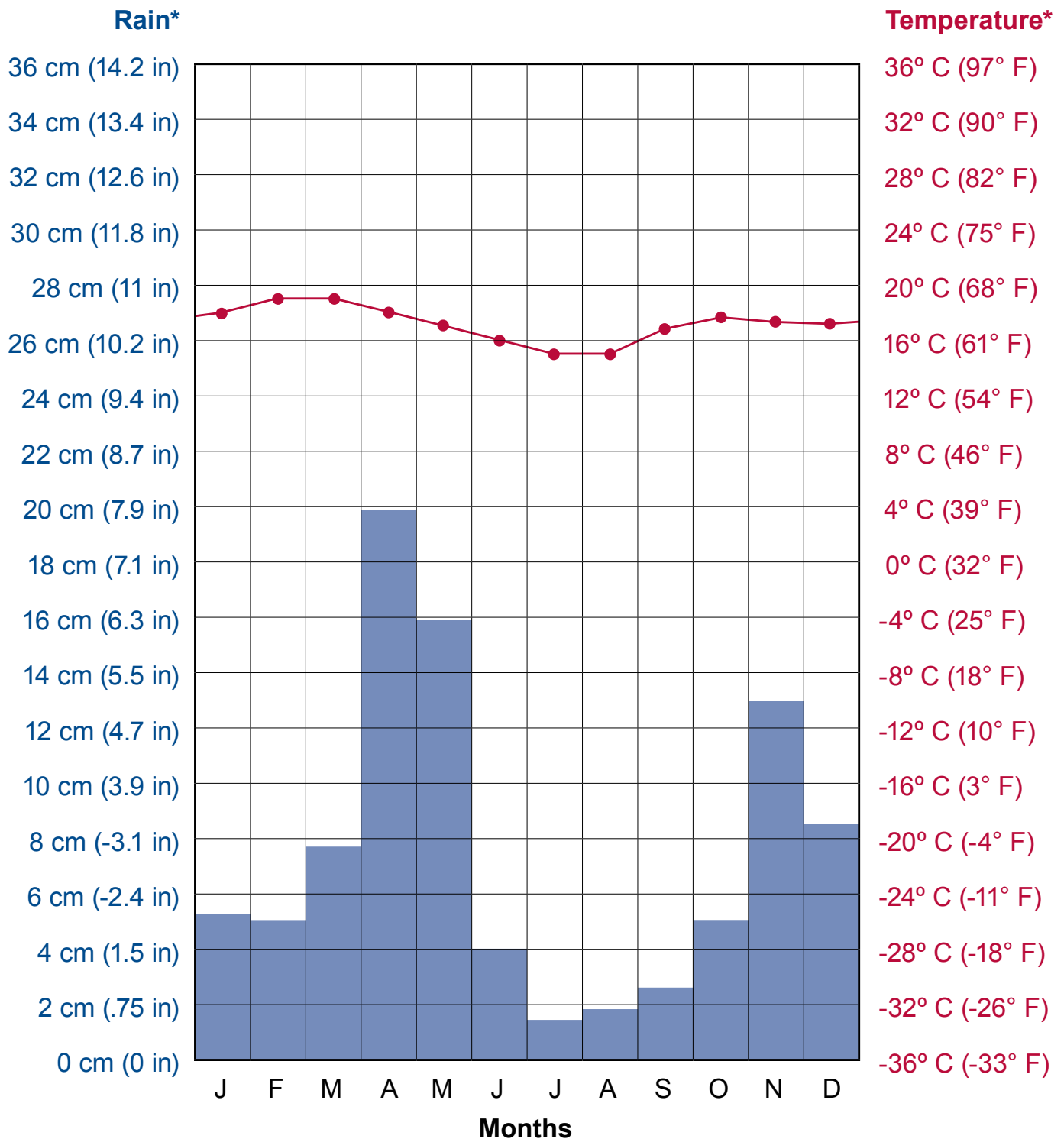
Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)



**Tundra (Location: Barrow, Alaska)**

\*Note: Conversions are approximate.

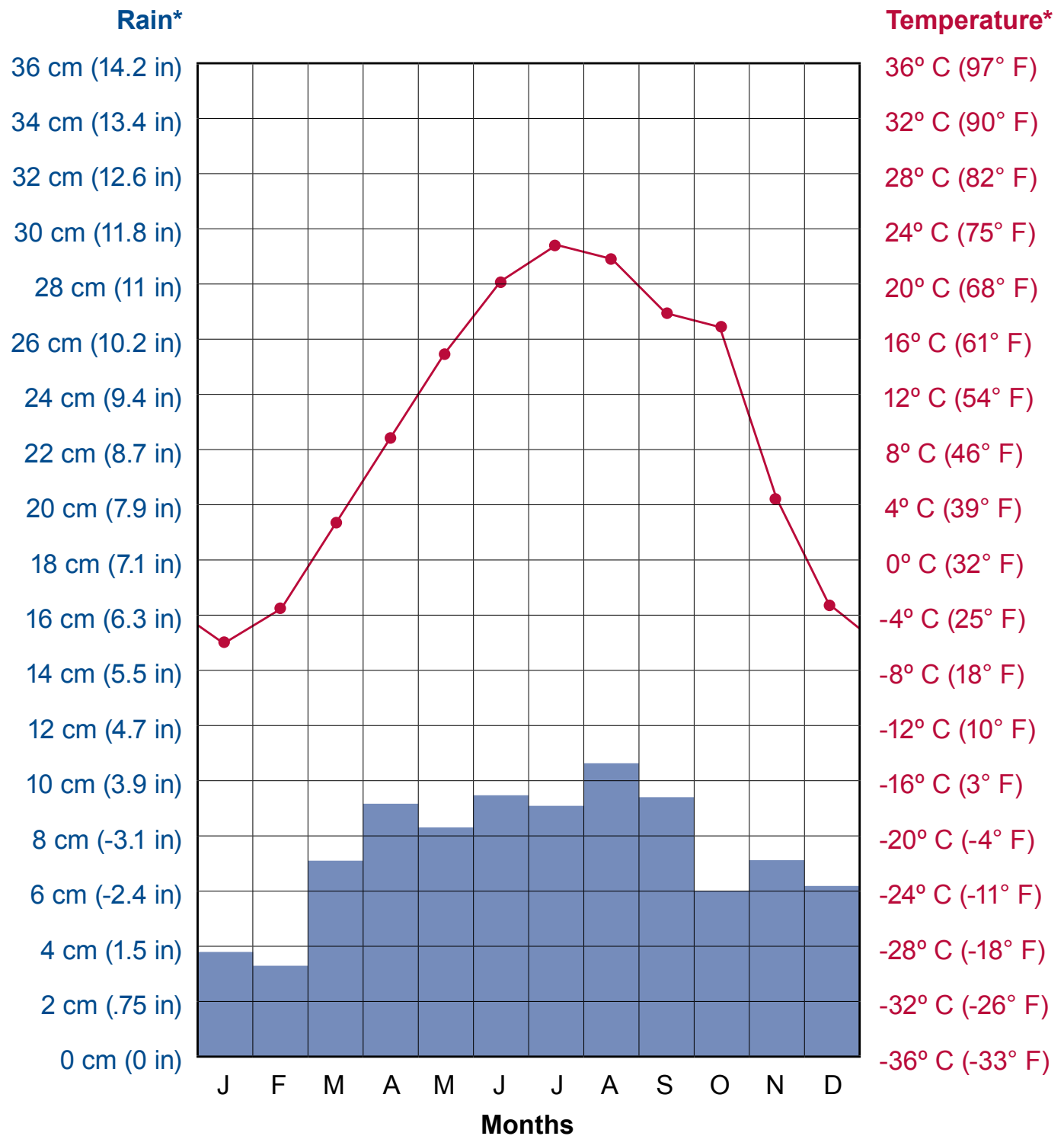
Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)

**Savanna (Location: Nairobi, Kenya)**

\*Note: Conversions are approximate.

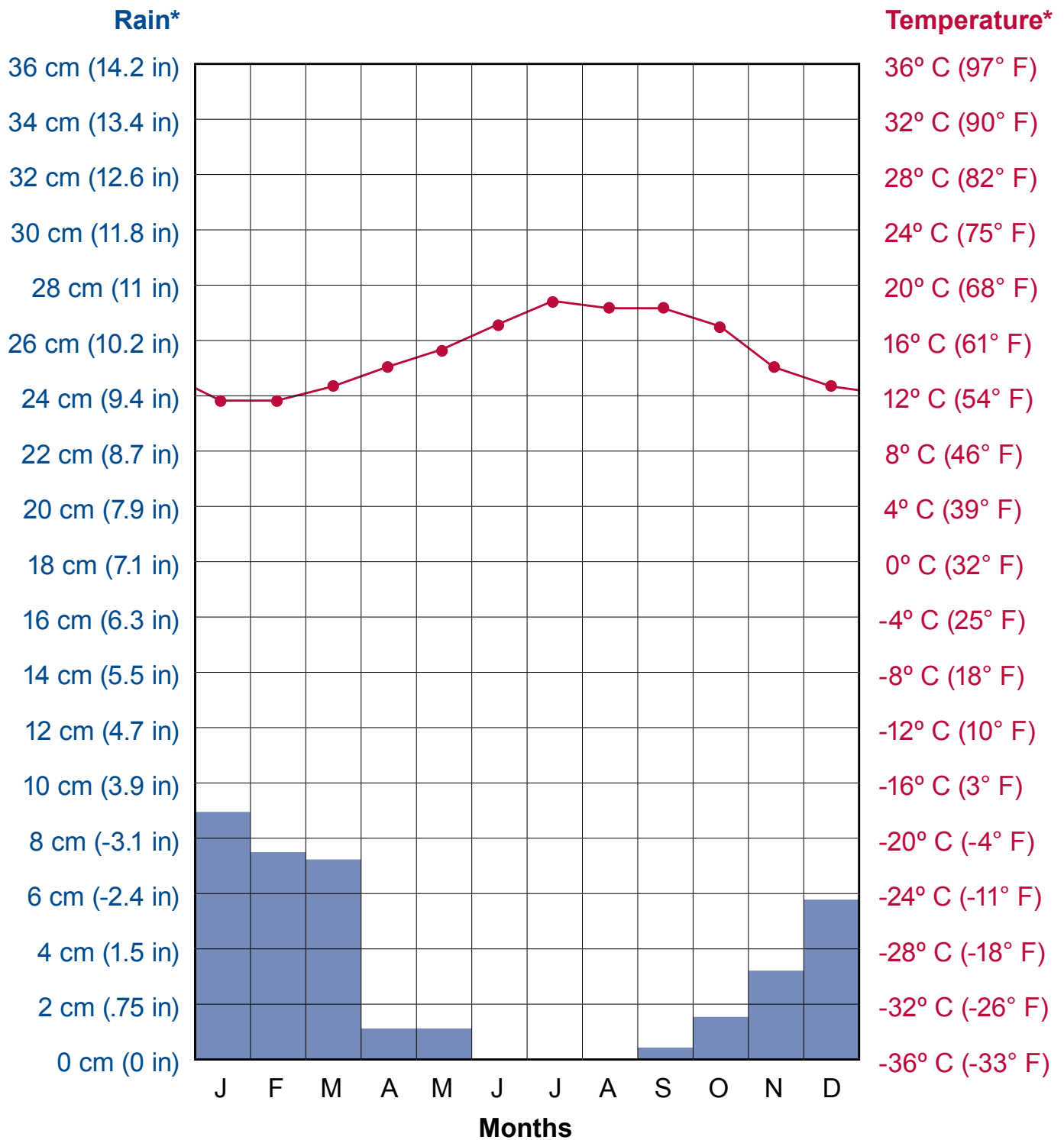
Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)



**Grassland (Location: Northeastern Illinois)**

\*Note: Conversions are approximate.

Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)

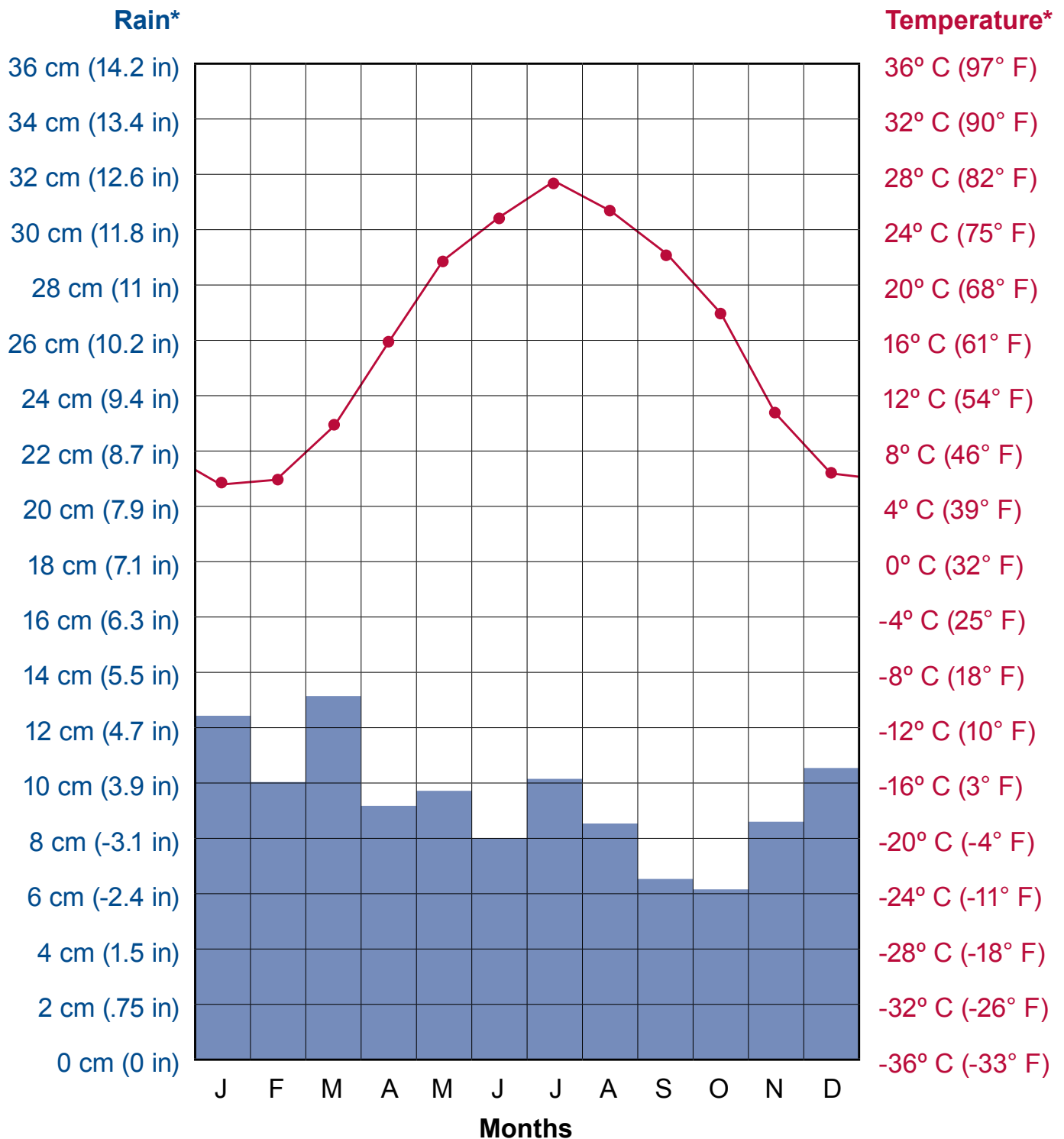
**Chaparral (Location: Santa Monica, California)**

\*Note: Conversions are approximate.

Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)



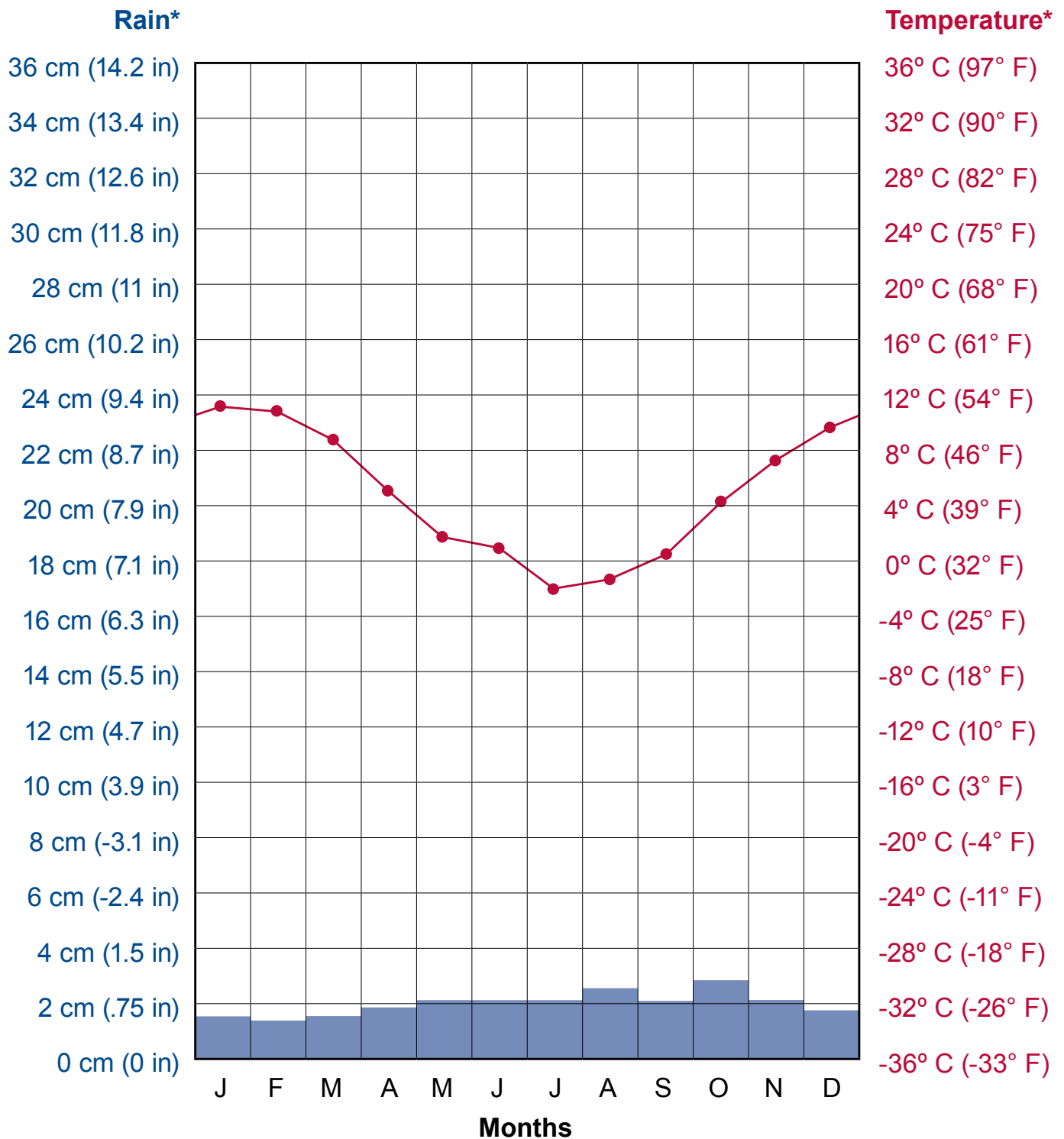


**Deciduous Forest (Location: Nashville, Tennessee)**

\*Note: Conversions are approximate.

Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)



**Alpine: (Location Charlotte Pass, Australia)**

\*Note: Conversions are approximate.

Source: Data from National Oceanic and Atmospheric Administration, [www.noaa.gov](http://www.noaa.gov)

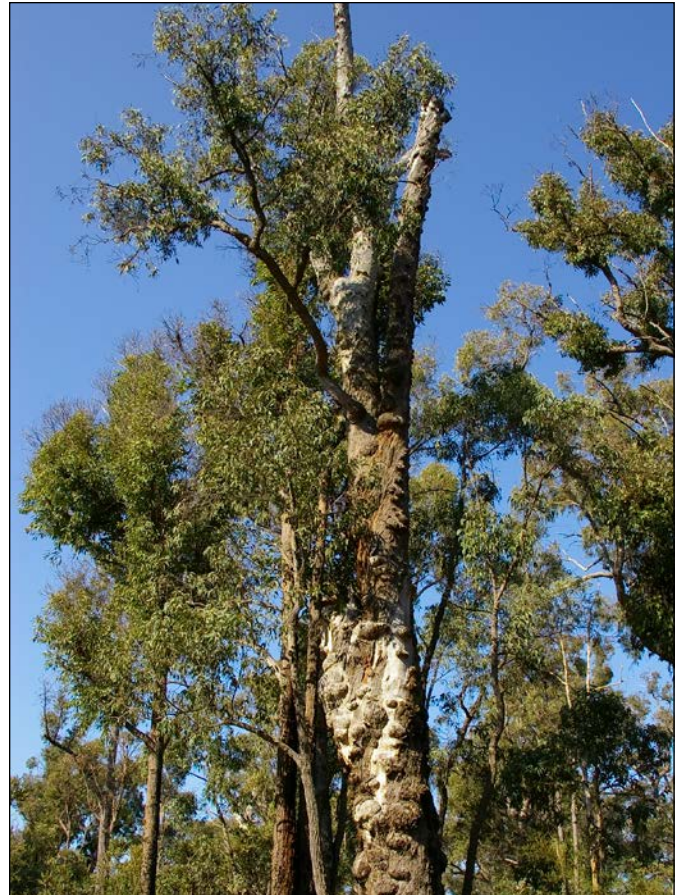
# Jarrah Tree

Jarrah trees grow in the Australian savanna. They often have large swellings near the base of the plant, at or just below, ground level. These swellings are called “lignotubers.” If a fire burns the part of the plant that is above ground, new shoots can grow from the lignotuber. This helps the plant survive fires, which are common in the hot, dry savanna climate.

**Biome:** Savanna

**Typical Vegetation:** Grasses with scattered trees and shrubs.

**Plant Characteristics:** Some savanna plants shed their leaves during the savanna biome’s long dry season. As a result, these plants do not lose precious water through evaporation from their leaf surfaces. Many savanna plants have leathery leaves, which limit water loss by keeping the plant cooler. Leaves may hang down so not much surface is hit by sunlight. This, too, helps keep the leaves cool and prevents water loss. Many savanna plants have shallow roots to capture rainwater. Others have long taproots that grow straight down, deep into the soil. During dry periods, these roots



help savanna plants find water that is stored deep below the surface. Like the jarrah tree, some plants in the savanna have lignotubers below the ground that help them grow back after a fire.

# Manzanita

Manzanita is a common shrub in the chaparral biome. Its leaves are small and thick. This helps reduce the amount of water lost from the leaves through evaporation. This is particularly important during the dry summer months typical of this biome.



**Biome:** Chaparral

**Typical Vegetation:** Shrubs that grow close together.

**Plant Characteristics:** Most chaparral plants have small, thick leaves. Small leaves do not lose as much water through evaporation as do large leaves. Sometimes the leaves of chaparral plants have a waxy coating or small hairs that also help prevent water loss. Some chaparral plants have shallow roots that grow wide around the plant to capture the limited rain that reaches the ground. Others have long taproots that grow straight down to the groundwater stored deep below the surface. Fires occur at regular intervals in the chaparral. If a fire burns the top of the plant, some plants in this biome can grow back quickly from woody growths at their base. The seeds of some chaparral plants grow only after a fire heats them.



# Saguaro Cactus

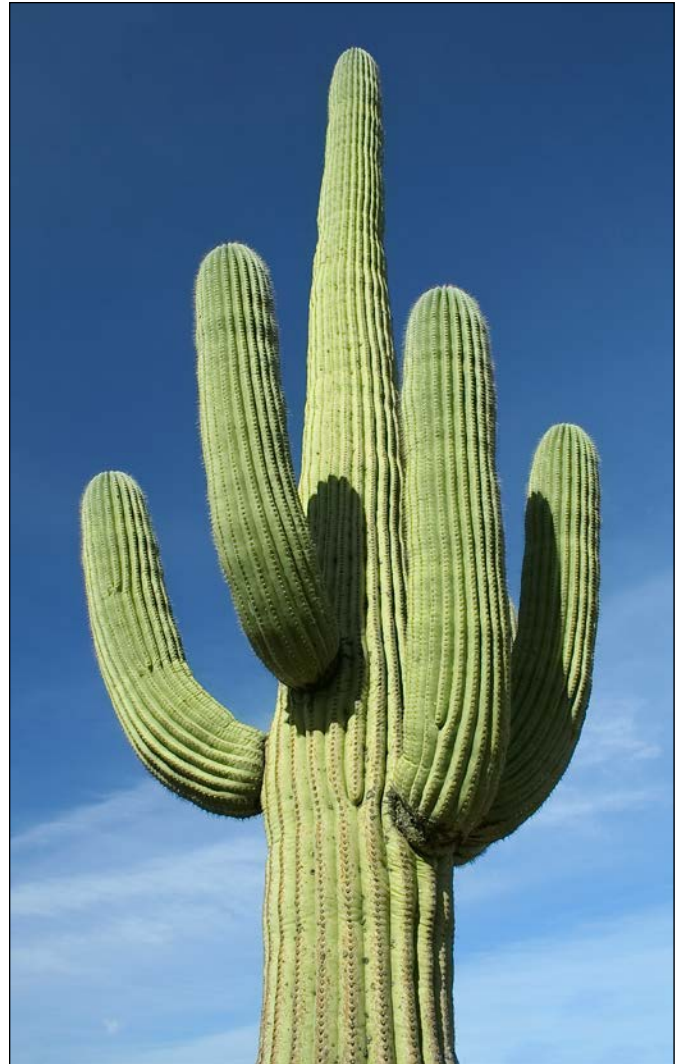
The saguaro cactus is found in the deserts of Arizona and northern Mexico. Saguaros have very tall, thick stems. The fleshy pulp inside the stem can expand like an accordion. This helps the saguaro store water when it is available. A waxy skin covers the stem and helps prevent water from evaporating from its surface. The spines on the stem keep animals from eating the cactus. Spines also help the saguaro prevent water loss.

**Biome:** Desert

**Typical Vegetation:** Low, scattered bushes and shrubs, some small trees, wildflowers, and cacti (in North and South America).

**Plant Characteristics:** Desert plants live in a very dry environment. Because there is little rainfall, these plants must be able to store and conserve water. They often have small leaves or spines. This prevents water loss through evaporation from leaf surfaces. Many have spines, which shade the plant and help keep it cool. Spines also keep animals away from the plants. In long periods of dry weather, many desert plants shut down their life functions. This is called going “dormant.” Dormant plants can spring to life when water becomes available.

Many desert plants have shallow roots that spread out near the ground surface. This helps them collect rainwater when it falls.



Other desert plants have one long, straight taproot that reaches deep sources of water. Desert plant seeds are hardy. They can survive underground for a long time. They only sprout when conditions are right and water is available. They grow quickly to take advantage of the water supply.

# Buffalo Grass

Buffalo grass is a common grass of the North American shortgrass prairie. It has several features that help it live in the variable climate of the grassland biome. Buffalo grass can withstand drought, heat, and cold. In times of little rainfall, it dries out and becomes dormant. It has thin, shallow roots to take up as much water as possible when it does rain. Its underground root system keeps the plant alive in winter, even as the aboveground parts die. Buffalo grass seeds are protected from fires by burrs—prickly seed cases.



**Biome:** Grassland

**Typical Vegetation:** Grasses and forbs (herbs), very few trees or shrubs

**Plant Characteristics:** Grassland biomes generally have hot, dry summers and cold, snowy winters. Extensive root systems help grassland plants live with these varied conditions. The aboveground parts of the plants die in winter, but a vast underground network of roots, bulbs, and other structures keeps the plants alive. The root systems of grassland plants can be longer than the plants are tall. This underground network helps the plants store water, obtain nutrients, and survive fires. Fires can be common in the grasslands. Because there are not a lot of large, woody plants, fires tend to burn quickly and not cause much damage to the soil. They remove dead grasses on the surface, making way for new plants to emerge in spring. Many of the seeds are protected from fires by thick seed cases. Some survive long periods underground until conditions are right for them to sprout.



# White Oak Tree

White oaks are among the most common trees in deciduous forests in the eastern United States. They have large leaves to help efficiently gather the Sun's energy when days start getting longer in spring. In the fall, white oaks—like other deciduous plants—drop their leaves to avoid having to maintain them during tough winter conditions when they would be damaged. White oak leaves change color in the fall when the leaves stop making a chemical called chlorophyll. Chlorophyll is needed for photosynthesis. It is also what makes leaves green. When the tree stops producing chlorophyll, the yellow, orange, and red colors can be seen before the leaves drop off.

**Biome:** Deciduous Forest

**Typical Vegetation:** Large trees that lose their leaves in fall; smaller trees, shrubs, ferns, mosses, and lichen.

**Plant Characteristics:** The climate in the deciduous forest biome usually is not too cold or too hot. Because of this, many different plants can live in this biome. The plants must be able to survive four distinct seasons: spring, summer, fall, and winter. During the cold winter, little water is present, so the trees protect themselves from losing too much water by

dropping their leaves in the fall. Losing their leaves also protects the trees from damage by cold temperatures. The leaves grow back in spring as the days lengthen and water and nutrients become available.

Deciduous trees grow tall to capture the sunlight. Their branches spread wide to collect sunlight for photosynthesis. Their wide root systems collect water and nutrients from the area around their trunks.





# Orchid

Many kinds of orchids grow in the tropical rainforest biome. About 70 percent of them are epiphytes. Epiphytes are plants that grow high in the forest canopy, where there is plenty of sunlight. Epiphytes get their nutrients directly from the air, falling rain, and bits of leaf litter. Their roots do not touch the forest floor.

Orchid roots have a large surface area. This helps the plant absorb nutrients and water quickly. Many have a bucket-like shape that also helps collect water and food. Their stems store water so they can survive dry periods. Orchids produce a huge number of tiny seeds that wind can easily carry. If not for this important feature, few orchid seeds would reach the forest floor.

**Biome:** Rainforest

**Typical Vegetation:** Very tall trees with high branches; many vines, epiphytic ferns, and flowering plants in the trees; large-leaved plants and seedlings on the forest floor.

**Plant Characteristics:** Rainforest trees grow very tall and straight to compete for sunlight. The higher they reach, the more sunlight they



can capture. The leaves on the high branches are small, dark, and leathery to reduce water loss. They have grooves and drip tips so that water rolls off easily. This keeps the leaves from rotting in the wet climate. There are many epiphytes—vines and flowering plants growing high in the leafy branches. Some “strangler” vines use the trees as support. Many of the tall trees have broad bases for extra support in the damp soil. The forest floor is shaded and dark. Most plants on the ground have large leaves to capture as much sunlight as possible.



# Reindeer Moss

Despite its name, reindeer moss is actually lichen. Lichens are made up of fungi and algae growing together on a rock or tree trunk. The fungi support and protect the algae. The algae photosynthesize and produce food for the fungi. The algae and fungi need each other to survive. Lichens can photosynthesize even in low temperatures and low light. They are not easily damaged by frost. With these characteristics, lichens can grow well in the Arctic tundra. When there is not enough water or light, lichen can dry out and go dormant until conditions change. Even after long dormant periods, they can begin to grow again.

**Biome:** Tundra

**Typical Vegetation:** Low shrubs, mosses, lichens, liverworts (moss-like plants), and grasses.

**Plant Characteristics:** Few plants can survive the extreme cold and low light of the tundra biome. No trees live in this region. Tundra plants grow close together and low to the ground. This helps them withstand cold temperatures and dry winds. The tundra frequently is covered with snow. Some tundra plants can grow under snow. Tundra plants

have small leaves to avoid losing water through evaporation. Most tundra plants are dormant in winter.

There are two layers to the Arctic ground. The permafrost layer is permanently frozen. Neither plant roots nor water can make their way into the permafrost. Therefore, tundra plants have shallow roots. Above the permafrost, the surface layer thaws each summer. Flowering plants grow and reproduce quickly during the short summer season when the ground is free from ice.



# Siberian Spruce

The Siberian spruce is one of many conifers of the taiga biome. Conifers are trees with needle-like leaves and seeds that develop in cones. They are evergreen trees; they keep their leaves throughout the year. The spruce's leaves have a waxy coating that is waterproof. The narrow leaves also limit the amount of water lost through evaporation. These characteristics are important during the winter, when the taiga ground freezes and the tree's roots cannot get water. The branches of the Siberian spruce droop a little. This gives the tree a cone-like shape, which helps keep

snow from building up on the branches. This prevents branches from getting too heavy and breaking off.

**Biome:** Taiga

**Typical Vegetation:** Tall conifers; few smaller trees, shrubs, ferns, and mosses on the forest floor.

**Plant Characteristics:** Taiga plants must survive cold, long winters. They grow and reproduce only during the short, summer seasons. Most plants in the taiga biome are conifer trees. Their cone-like shape keeps snow from building up on their branches. In taiga winters, the ground is frozen and little water is available to the trees' roots. Conifers have small, needle-like leaves that prevent water loss. Conifers keep their needles throughout the year. Growing new leaves in spring requires a lot of energy. The soil in the taiga does not contain many nutrients, and the Sun is usually low in the sky in these regions. The resources for plant growth are limited. As soon as temperatures start to warm, the dark green needles absorb sunlight. The trees are ready to photosynthesize and take advantage of the growing season.



# Himalayan Rhododendron



The Himalayan rhododendron grows high in the mountains of Northern India, Bhutan, and Nepal. This evergreen plant has leathery leaves. These features help the plant conserve water. The upper side of the leaf is dark green and shiny. This reflects the intense sunlight of the high mountain elevations and slows evaporation from the leaves. The rhododendron grows very quickly during the alpine biome's short summers.

**Biome:** Alpine

**Typical Vegetation:** Mostly low-growing plants that live for several years; some evergreen trees at lower elevations; smaller trees and shrubs at higher elevations.

**Plant Characteristics:** Most alpine plants grow low to the ground. This protects them from the strong, cold winds common in this biome. Plants in this biome must also protect themselves from the intense sunlight. Their leaves are thick and leathery. Many alpine plants have special underground stems that store food during the summer. During the freezing winters, most plants slow or stop their growth. The parts above ground die back, but the underground parts remain alive. This helps the plant survive in its cold, harsh environment. When spring arrives, the plants grow and reproduce quickly, using the food stored in their stems until the soil thaws and roots can absorb water and nutrients.

